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Testimony

Before the Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform, House of Representatives

For Release on Delivery  
Expected At  
10:00 a.m.  
Thursday,  
June 15, 2000

DEFENSE  
ACQUISITIONS

Use of Cost Reduction  
Plans in Estimating  
F-22 Total Production  
Costs

Statement of Allen Li, Associate Director  
Defense Acquisitions Issues  
National Security and International Affairs Division



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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss our ongoing work on the impact that production cost reduction plans are projected to have on the Air Force's F-22 Raptor Program.

The F-22 Raptor is an air superiority aircraft being developed to replace F-15 fighter aircraft. Lockheed Martin Corporation and Pratt & Whitney Corporation are the contractors for the airframe and engine, respectively. Development, which started in 1991, is scheduled to be completed in August 2003. The Air Force plans to enter low-rate initial production in December 2000. Appendix I lists products we have issued that relate to the F-22 program.

Projections of higher production costs have been a source of concern for several years. In 1996, because of potential cost increases, the Air Force established a team--known as the Joint Estimating Team--to review the total estimated cost of the F-22 program. The team concluded that the cost of production could grow substantially from the amounts planned, but that cost reduction initiatives could be implemented to offset that cost growth. The Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics generally adopted the team's recommendations to change certain aspects of the program, as well as a plan to define and implement cost reduction initiatives. F-22 production costs were also discussed in the National Defense Authorization Act for Fiscal Year 1998 (P.L. 105-85, Nov. 18, 1997). That act limited the total cost of F-22 production but did not specify the total number of aircraft to be procured. The most recent production costs estimates were completed by the Air Force and the Office of the Secretary of Defense in 1999. Both of these estimates considered cost reduction initiatives known as production cost reduction plans. Hundreds of these plans--totaling \$21 billion--had been identified by the airframe and engine contractors, with participation by the Air Force's F-22 program office.

At the Subcommittee's request, we are now reviewing the impact of the production cost reduction plans on F-22 costs, specifically focusing on (1) determining the status of cost reduction plans, including some plans not yet implemented, and identifying Air Force procedures for reporting on the plans, and (2) comparing the 1999 cost estimates developed

by the Air Force and the Office of the Secretary of Defense with the congressional cost limitation. My statement today presents our preliminary observations.

### RESULTS IN BRIEF

Of the total \$21 billion in cost reductions identified by the F-22 contractors in their plans, about half of that amount is categorized as implemented and the other half as not yet implemented. Our review of 10 cost reduction plans not yet implemented indicates that achieving reductions from 3 of the plans will depend on decisions by the Office of the Secretary and/or the Congress; implementing these cost reduction plans is therefore beyond the Air Force's ability to control. In addition, one of the three plans--to delay establishing an Air Force depot maintenance capability for the F-22--may only defer the costs to future years. Also, one of the three plans, estimated to reduce costs by almost a half billion dollars, was so uncertain that neither the Office of the Secretary nor the Air Force considered it to be likely to achieve the cost reduction proposed.

Both Office of the Secretary and Air Force cost estimators projected F-22 production costs that exceeded the congressional cost limitation of \$39.8 billion in effect at that time. In 1999, after considering the potential of all the cost reduction plans, the Air Force estimated F-22 production costs at \$40.8 billion, and the Office of the Secretary of Defense estimated production costs at \$48.6 billion. Both estimates were based on the production of 339 aircraft. The two estimating groups did not use the same estimating methods, nor did they make the same assumptions about which cost reduction plans were already implemented or about the cost reductions achievable from plans not yet implemented. For example, for cost reduction plans that were not yet implemented, the Air Force's estimating group allowed \$10.2 billion (of the total estimate of \$10.8 billion) for potential future cost reductions, and estimators from the Office of the Secretary allowed \$6.1 billion. The Office of the Secretary's estimate exceeded the Air Force's estimate by \$7.8 billion, or 19 percent. The difference is attributable to the Office's higher estimates of the cost of production (\$3.7 billion) and lower estimates of the impact of production cost reduction plans not yet implemented (\$4.1 billion). The Office of the Secretary cost estimates exceeded the

congressional cost limitation by about \$ 8.8 billion. Putting the higher estimate in perspective, if the Office of the Secretary estimate is correct and additional cost reduction plans are not developed and implemented, we estimate that the Air Force would have to buy about 85 fewer F-22 aircraft than now planned to stay within the congressional cost limitation. Although Air Force cost estimators projected a total of \$40.8 billion in production costs, the official Air Force cost position was \$39.8 billion, the same as the congressional cost limitation. Air Force officials said that the Air Force selected the \$39.8 billion as its official cost estimate because the detailed breakout of the estimate for fiscal years 2001 through 2005 was about the same as that budgeted for those years. They said the difference between the estimate and the budget is primarily associated with the estimate for years after 2005.

F-22 COST REDUCTION PLANS WORTH BILLIONS  
HAVE NOT YET BEEN IMPLEMENTED AND SOME DEPEND  
ON CONGRESSIONAL OR DEFENSE DEPARTMENT ACTION

In response to recommendations of the Joint Estimating Team, contractors and the F-22 program office proposed cost reduction plans to use enhanced production technology, improved manufacturing techniques, and revised acquisition principles to buy materials. These plans show changes to business design, processes, and practices to realize cost reductions. Cost reduction plans are categorized "implemented" if they meet one of several criteria such as the impact of the reduction being reflected in a current contract price. The estimated value of cost reduction plans is shown in table 1.

Table 1: Status of Contractors' Production Cost Reduction Plans  
Then-year dollars in billions

Reason for reduction	Implemented	To be implemented	Total
Improve manufacturing processes and incorporate new technology	\$2.7	\$5.2	\$7.9
Improve efficiency and reduce supplier costs	2.0	1.7	3.7
Resolve obsolescence and diminishing sources issues	1.3	.3	1.6
Improve material procurement strategies	.7	.3	1.0
Apply performance-based contracting practices	.5	0	.5
Defer or avoid government investment in depot maintenance capability	3.0	.3	3.3
Award production contracts for multiple years	0	1.8	1.8
Manufacture Joint Strike Fighter and F-22 components in the same plants	0	1.2	1.2
<b>Totals</b>	<b>\$10.2</b>	<b>\$10.8</b>	<b>\$21.0</b>

Note: The F-22 program office provided input to the contractors' plans.

Source: F-22 program office data.

As shown in table 1, about half of the estimated value of the identified cost reduction plans are categorized as implemented. Allocated equally over a planned procurement of 339 F-22 aircraft, a \$21-billion cost reduction equates to about \$62 million per F-22 to be produced. This amount of reduction per F-22, if achievable, is significant. For example, F-15 aircraft, were procured in fiscal years 1996-98 at an average unit cost of about \$46 million.

#### Implementation of Some Remaining Cost Reduction Plans Not Ensured

Achievement of reductions from 3 of the 10 plans not yet implemented that we reviewed will depend on decisions of the Office of the Secretary of Defense and/or the Congress. Thus, the Air Force cannot control implementation of the cost reduction plans.

One of the three plans estimates a cost reduction of about \$2.6 billion and proposes that all F-22 depot-level maintenance be performed by the contractor until at least 2008. Under this proposal, the Air Force would not have to develop a capability to perform depot-level maintenance during production and would thus save production costs. Before this plan can be implemented, the Secretary of the Air Force must determine it conforms to 10 U.S.C. 2464, which describes the maintenance of a core logistics capability, and 10 U.S.C. 2466, which establishes a ceiling on contractor performance of depot maintenance.

This plan may only defer some costs until after completion of production. The plan states that its purpose is to reduce costs by delaying the establishment of government depot capabilities until the system matures, which is defined as accumulating 100,000 flying hours in fiscal year 2008. It also states that the contractor support concept will be implemented to reduce the required depot investment and that most of that expense to develop an Air Force capability will be deferred until about 2012. The last buy of F-22 production aircraft is scheduled for fiscal year 2011. The Air Force would decide at that time whether to fund the costs of an Air Force depot-maintenance capability with procurement or operation and maintenance appropriations. If these costs are deferred until after the F-22 production program is complete, they will no longer count against the congressional cost limitation.

Another cost reduction plan that is dependent on decisions by the Congress and the Office of the Secretary estimates that F-22 costs will be reduced by about \$1.05 billion through lower overhead rates and increased buying power, since many of the same contractors and subcontractors that are building the F-22 will also build the Joint Strike Fighter. The Congress and the Office of the Secretary control the schedule and quantity of the Joint Strike Fighter aircraft. Therefore, this cost reduction is dependent on decisions being made on a program external to the F-22. If the Joint Strike Fighter program is not approved or is delayed, then the F-22 production program will not achieve the projected cost reductions.

The third cost reduction plan requires the Congress to approve the multiyear procurement of the F-22, which the airframe contractor estimates will reduce the cost of production by about \$1.5 billion. The contractor proposes that production be contracted for 5 years in

advance, beginning in 2004. According to the plan, because of cost reductions available through long-term commitments such as a 5-year contract, the subcontractors and the contractor would accept lower prices for the aircraft being procured. A multiyear contract must meet specific criteria and be approved by the Congress. Specifically, the multiyear contract must result in substantial savings compared to awarding annual contracts, the item being bought must have a stable design and not have excessive technical risks, and the estimated cost of the system and the estimated cost avoidance from the multiyear procurement are realistic. The Air Force plans to award a multiyear contract for fiscal year 2004 contract and will need congressional approval for a multiyear contract in fiscal year 2003 to support advance procurement funding.<sup>1</sup> Since the F-22 development program is not scheduled for completion until August 2003, the potential exists that the F-22 program will not meet the multi-year procurement criteria by 2003.

#### Status of One Cost Reduction Plan Is Uncertain

Another cost reduction plan of uncertain status involves obtaining titanium sponge from the Defense Logistics Agency's National Defense Stockpile Center at no cost and providing it to the manufacturer instead of paying the manufacturer for the raw material. This plan is estimated to ultimately reduce the production cost of the F-22 by \$458 million. It assumes that the cost of titanium sponge would be \$3.00 per pound if purchased by the contractor and that about 30 million pounds would be needed. It further assumes that the funds not expended for titanium sponge, about \$90 million, would be used to invest in additional cost reduction plans, and thus reduce the total cost by \$458 million. Although the plan assumes that \$4.00 to \$5.00 in cost reductions will be achieved for each dollar invested, the contractor and the Air Force have not identified the specific projects in which the funds would be invested. This plan was not used to reduce estimated production costs by either cost estimators from the Office of the Secretary or the Air Force because of the uncertainty of congressional approval.

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<sup>1</sup> The Air Force often requests advance procurement funding to initiate procurement of the long-lead time materials and effort needed to ensure that the delivery schedule can be met for aircraft that are to be procured in the next fiscal year.

Although this plan might reduce F-22 production costs, the cost to the government would not be reduced by that amount. If the National Defense Stockpile Center does not give titanium sponge to the F-22 program, it can sell it to the private sector and create income for its own fund. In fiscal year 1999 the Center's sales of titanium sponge averaged \$1.94 per pound. Since the Air Force will need about 30 million pounds of titanium sponge for F-22 production, the lost revenue to the Center could be about \$60 million (\$1.94 per pound times 30 million pounds). Therefore, what may be significant cost reduction for the F-22 program could result in some lost revenue for the Defense Logistics Agency.

Individual Plans Tracked but

Regular Reporting Not Accomplished

The Air Force and airframe and engine contractors have established procedures to track the status of the production cost reduction plans. Both contractors have developed an information system that records the identified plans, the expected cost reduction from each of them, and their implementation status. The systems and the procedures were established to generate, evaluate and implement cost reduction plans. The Air Force and the contractors monitor the status of the plans using data from the system.

The Under Secretary of Defense for Acquisition, Technology, and Logistics requested the Air Force to report quarterly on the status of F-22 costs. However, Air Force quarterly reports to the Under Secretary have not included status information on cost reduction plans since June 1999. The data is available to make detailed reports. For example, the Air Force is able to categorize plans as implemented or yet to be implemented and to perform specific searches of the contractor's information system.

OFFICE OF THE SECRETARY AND  
AIR FORCE ESTIMATES EXCEEDED  
THE CONGRESSIONAL COST LIMITATION

The Air Force and Office of the Secretary cost estimating groups did not use the same methods to estimate the cost of F-22 production, nor did they use the same assumptions about which cost reduction plans were implemented or not yet implemented. After considering the potential cost reductions, both estimates exceeded the congressional cost limitation that was in effect at the time the estimates were prepared. However, the Air Force used the cost limitation as its cost position.

Differences Between the Air Force and the  
Office of the Secretary Estimates

The two groups used different estimating methods, such as different assumptions regarding (1) production rates, (2) the impact of breaks in production, and (3) which historical data to use. These differences caused the Office of the Secretary estimate to be higher than the Air Force estimate for the following reasons:

- Air Force cost estimators assumed that the eight production representative test vehicles approved for purchase in fiscal years 1999 and 2000 would generally be produced as two lots of four aircraft each, based on the contractors' delivery schedules. Office of the Secretary estimators assumed the contractors would produce the eight aircraft to fit their manufacturing schedules most efficiently.
- Air Force cost estimators assumed that as a result of a stop in production of some of the avionics items, the higher cost reductions normally experienced in manufacturing the early units would also occur on later units. Cost estimators from the Office of the Secretary did not assume the higher cost reductions would be experienced on the later units. As a result, the Air Force's estimate was significantly lower than the Office of the Secretary's estimate.

- The Air Force and the Office of the Secretary used different historical cost data to estimate the cost of the F-22 avionics. For example, the Air Force used experience on F/A-18 avionics and the Office of the Secretary used experience on multiple systems.

#### Different Allowances for Cost Reduction

#### Plans Not Yet Implemented

The Air Force estimated that costs would be reduced by \$10.2 billion as additional cost reduction plans were implemented, while the Office of the Secretary estimated it would achieve \$6.1 billion in cost reductions. Among the reasons for the different amounts are that the estimators used different baselines from which to calculate a reduction, different estimated returns on funds invested to reduce costs, and different assumptions on the percent of reductions likely to occur by eliminating nonproductive steps. As a result of the differences, the Office of the Secretary allowed less for cost reductions than the Air Force.

According to Air Force officials, there were some differences because the two estimating groups used different assumptions about which plans were already implemented. For example, the Office of the Secretary considered about \$1 billion in reductions associated with the Joint Strike Fighter and radar production as implemented. Because the Joint Strike Fighter has not been approved for production, the Air Force did not consider that cost reduction to have been implemented.

#### Comparison of Estimates With

#### Congressional Limitation

As shown in table 2, the Air Force estimate was \$40.8 billion after allowing for \$10.2 billion of additional expected cost reductions that have not been implemented. The Office of the Secretary estimate was \$48.6 billion after allowing \$6.1 billion for additional cost reductions

that have not been implemented. Both of these estimates exceeded the cost limitation of \$39.8 billion in effect at that time<sup>2</sup>.

Table 2 Production Cost Estimates for the F-22

Then-year dollars in billions

Description	Office of the Secretary estimate	Air Force estimate	Difference
Cost estimate after considering cost reductions	\$54.7	\$51.0	\$3.7
Allowance for cost reductions that have not been implemented	(6.1)	(10.2)	4.1
Net cost estimate	\$48.6	\$40.8	\$7.8

Note: Parentheses indicate negative numbers.

Source: Office of the Secretary and Air Force data.

Consequently, as a result of the differences in estimating techniques and allowances for the cost reduction plans, the Office of the Secretary estimated the cost of the F-22 production program about \$7.8 billion or 19 percent higher than the Air Force. Officials from the Office of the Secretary said they consider the 19 percent difference significant. We agree that the difference is significant. If the Office of the Secretary estimate is correct and additional cost reduction plans are not developed and implemented, the Air Force would have to buy about 85 fewer aircraft than are now planned to stay within the congressional cost limitation of \$39.8 billion.

Air Force Selected Cost Limitation  
as Its Official Cost Position

Although the Air Force cost estimate was \$40.8 billion, its official cost position is \$39.8 billion, the same as the congressional cost limitation. According to Air Force officials, the Air Force would normally select an estimated cost that would provide an equal chance that the estimate was either higher or lower than the actual cost of the program. For the F-22

<sup>2</sup> In late 1999, the Air Force adjusted the cost limitation to \$37.6 billion and revised the number of aircraft to be procured to 333 because 6 aircraft that were part of the production program will be procured as part of the development program and thus are now subject to a separate cost limitation for F-22 development.

production cost estimate, that amount was \$40.8 billion, which included about \$1.2 billion for risk uncertainties. The Air Force, however, used \$39.8 billion (the congressional cost limitation amount) as its cost position, which, according to Air Force calculations, was twice as likely to be below the actual cost than above it. The Air Force said it selected the \$39.8 billion as its cost position because the detailed breakout of the estimate by fiscal year was equal to or less than what the Air Force budgeted for fiscal years 2001 through 2005 and the estimate for the years beyond 2005 was more uncertain; that is, the further in the future the estimate is for, the less likely it is to be accurate. Therefore, rather than select an estimate that exceeds the cost limitation, the Air Force selected an estimate equal to the cost limitation.

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Mr. Chairman, that concludes my statement. I will be happy to respond to any questions you other Members of the Subcommittee might have.

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#### Contacts and Acknowledgments

For future questions regarding this testimony, please contact Allen Li, (202) 512-4841, or Robert Murphy, (937) 258-7904. Individuals making key contributions to this testimony include Mark Abraham, Leonard Benson, C. Todd Brannon, Edward Browning, and John Van Schaik.

RELATED GAO PRODUCTS

*Defense Acquisitions: Decisions on the Joint Strike Fighter Will Be Critical for Acquisition Reform* (GAO/T-NSIAD-00-173, May 10, 2000).

*Budget Issues: Budgetary Implications of Selected GAO Work for Fiscal Year 2001* (GAO/OCG-00-8, Mar. 31, 2000).

*F-22 Aircraft: Development Cost Goal Achievable If Major Problems Are Avoided* (GAO/NSIAD-00-68, Mar. 14, 2000).

*Defense Acquisitions: Progress in Meeting F-22 Cost and Schedule Goals* (GAO/T-NSIAD-00-58, Dec. 7, 1999).

*Defense Acquisitions: Progress of the F-22 and F/A-18E/F Engineering and Manufacturing Development Programs* (GAO/T-NSIAD-99-113, Mar. 17, 1999).

*F-22 Aircraft: Issues in Achieving Engineering and Manufacturing Development Goals* (GAO/NSIAD-99-55, Mar. 15, 1999).

*F-22 Aircraft: Progress of the Engineering and Manufacturing Development Program* (GAO/T-NSIAD-98-137, Mar. 25, 1998).

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*Tactical Aircraft: Restructuring of the Air Force F-22 Fighter Program* (GAO/NSIAD-97-156, June 4, 1997).

*Defense Aircraft Investments: Major Program Commitments Based on Optimistic Budget Projections* (GAO/T-NSIAD-97-103, Mar. 5, 1997).

*F-22 Restructuring* (GAO/NSIAD-97-100BR, Feb. 28, 1997).

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